Public Works (190 /) Department.

G.O., No. 280-I W

DATED 18-6-1907.

1/35/6 copies of G.O.

20. 6. 07

The Notes
in this G.O. have been printed.

[Despatch Abstract.]

Periyar-Pambiar Investigation

Report shewing the results of the working of the Party employed on —— from November 1906 April 1907, recorded with remarks.

&/DW

P. W. 26.
2,000—6-7-06.

Indexed.
19.6.07

17/6

15.6.07

IRRIGATION.

Government of Madras.

PUBLIC WORKS DEPARTMENT.

Recd.
}1907.
Regd.

Enclosures

Spare copies

G.O., No. 280 I., 18th June 1907.

Periyar-Pambiar Investigation

Report showing the results of the working of the party employed on — from November 1906 to April 1907, recorded with remarks.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

READ—the following papers :—

I

G.O., No. 702 I., dated 27th June 1906.

II

Letter—from S. B. MURRAY, Esq., Executive Engineer, Periyár-Pambiar Investigation Party.
To—the Chief Engineer for Irrigation.
Dated—Madras, the 20th April 1907.
No.—20-E.I.

I have the honour to submit a report and map showing the results of the work of the party for the season which has just come to a close.

2. You will see from my report that I am strongly of opinion that the investigation should be continued as soon as work can start again after the monsoon is over. This year's work has proved that it is quite feasible to divert water from the Pambiar into the Periyár lake, and I have satisfied myself that I have located the best place for this to be done. What is now required is a very close investigation of this part of the country to enable a decision to be come to as to what works will be necessary. At the end of my report I have given, more fully, my proposed programme for next season's work.

3. If 1906-1907 was an average year in the Travancore Hills, and I understand that it was, it gives a very short working season. Rain and mist prevented anything like regular work until the middle of December, and similar weather began again in the middle of March, so there was practically only three months of weather suitable for surveying out of the six that the party was working.

4. If it is decided that further investigation is to be made and that I am to continue the work, I request that I may again have the services of Messrs. Tressler and Milner, Assistant Engineers, the former as soon as he returns from leave, and the latter from the 15th October. I have already arranged with them what work they are to begin on, pending my arrival. I would also ask that I may be informed as soon as a decision has been arrived at, so that I may send out explicit orders to Mr. Milner as to what I want done before I arrive.

5. I have not kept a copy of the map.

Enclosures.

Report.

After consideration, I have decided to write this report in the first person singular. What has to be said consists of description and opinion. The former I am able to give at first hand, the latter is my own, so it will be easier for me and will require less involved language, if I make the report more or less in the form of a personal narrative.

2. The question of making more use of the Periyár lake has been considered and discussed for many years, and it has been recognised that there were three different ways of effecting this object:—

(*a*) to raise the crest level of the lake escape and so increase the storage capacity of the lake itself;

(*b*) to lower the cutting between the lake and the tunnel so as to admit of more water being drawn off through the tunnel;

(*c*) to divert water from some other catchment area by means of a dam or a tunnel, or both, into the lake.

Estimates have been sanctioned, and work is now in progress, for the first two of the above improvements. The present report deals with the possibility of carrying out the third;

3. The only river, a supply from which could be put into the Periyár above the dam, is one known as the Pambiar, about 8 miles south and south-east of the lake.

When I began the investigation, very little was known about the Pambiar even by the Manaans (the local jungle people), but it was supposed that the Periyár and Pambiar flowed more or less parallel and about 10 miles apart. The only way to the river was along a track from the western end of the lake. I went over this piece of country and saw that at all events a survey could be made of it, so I set one Assistant to work there. I then tried up all the arms along the southern side of the lake to see if I could find any other way through, but everywhere I was met with a wall of almost impenetrable jungle, covering a high ridge of hills. Just at the top of the lake there was some grass country off to the south, so I put my other Assistant to work at that. My plan was to first survey the country wherever it was sufficiently open to admit of it, and then, when we had obtained a more intimate knowledge of our surroundings, to consider the possibility of a diversion. By the end of December I realised that the only way through would be at the south-west corner of the lake. At the upper end the country to the south rises abruptly and soon is more than 1,000 feet above the lake. I then ordered my Assistant working there, Mr. Tressler, to confine his attention to surveying the open country and to also try to push his way through the big jungle in a south-westerly direction with a view to eventually striking the Pambiar river. Mr. Tressler's work is shown on the right-hand side of the map which accompanies this report. He has surveyed all the open grass country at the upper end of the lake, and when the big jungle was met with at Billings Gate, he started to cut, by compass, a path through to the south-west. On the way we left a good survey station (which we named "Pisgat") on a hill 5,000 feet about M.S.L. From this hill the whole country to the south, west and north can be seen, and it will be very important as a checking station. A little further on we made a temporary camp, at Jericho, and there I left Mr. Tressler. He eventually cut his way to the west and joined me at the Pambiar camp.

4. Now for the work of my other Assistant, Mr. Milner, I first set him to cut a regular path through from the Periyár lake to the Pambiar river and then to take a careful line of levels from lake to river. This worked out as follows:—

Periyár lake—full lake level (in 1907)	+ 2,981·36
Pambiar river—approximate bed level at probable site of dam.	+ 3,200·00

which makes the proposal feasible so far as levels are concerned. It will be seen from the map that there is a high ridge between the lake and the river, and at B. M. No. 16, near survey station No. 9, the level is + 4,041·36. This would of course mean a tunnel. These levels and the knowledge of the country obtained in getting them practically settled the way in which the diversion would have to be carried out, and which I will describe directly.

5. As soon as I was satisfied that a diversion could be made, I began a complete survey of the country so far as it was possible to do it. In grass land there were no great difficulties, but in the jungle the undergrowth was so thick that we soon found that the only way to work was to follow up the beds of the streams, which gave very slow progress, and there has not been time this season to trace any one of them to its source. We tackled the Pambiar itself this way, but when Mr. Milner had got about 5 miles from the Pambiar camp (our last one) the bed got so steep and rough that he had to stop. Next season I propose to put up a camp near the river, somewhere east of station No. 5, and if necessary another one still further up. The whole of upper waters of the Pambiar flow through dense jungle, and I know of no other way of tracing it to its source except by following up the bed. It is very important to follow the Pambiar up to its source and also its tributaries, as that will be the only way to find out what its catchment area is. Any other way of carrying out a survey in dense jungle like this is out of the question.

6. With the knowledge of the country which I now possess I am satisfied that the best way to direct water from the Pambiar river into the Periyár lake is as follows. The Pambiar will have to be dammed just below where the line between survey stations 2 and 8 crosses the river. There is a very good rocky barrier across the river at this place, on which to build a dam, and there is also an excellent site for an escape. A dam here would hold up water not only in the Pambiar, but also in what is called on the map "No. 5, River", one tributary of which runs from the north and starts quite close to the "Meenar" river. The country between No. 5 River and the Meenar is flat, and it would not require a high dam on the Pambiar or deep cut, north of station No. 22, to put Pambiar water into the Meenar. On the north side of the Meenar the country rises abruptly, as will be seen from B.M.'s 23–16, and a tunnel would have to start here, almost from the river itself. This tunnel would approximately follow the line I have shown, and would end at the "Kullar" river, which is also out of the Periyár catchment. This Kullar river has a very rapid fall and at B.M. No. 8 it is + 3,100. A low dam would be necessary about this place. There is very good site, with rock showing,— and this would flood a low flat valley lying to the north, and which would give a splendid site for a reservoir of considerable capacity. At the north end of this valley there is a very low ridge, about + 3,120, which divides the Kullar valley from the Periyár lake.

7. If this scheme is accepted, the works that would be required to divert Pambiar water into the Periyár lake would be—

(1) a dam across the Pambiar,
(2) a short cut into the Meenar,
(3) a tunnel through the Kullar,
(4) a dam on the Kullar.

I can make no attempt at present to say what height the dams should be or, to any degree of accuracy, what length the tunnel would be. It all depends upon how the Pambiar water is to be treated. I have obtained from the Executive Engineer, Madura Division, a statement (copy attached) showing when the Periyár lake has surplussed during the last 11 years, and from this statement it will be seen that in 6 out the 11 years the lake has surplussed in December and once in November, so that during this period there would not have been much object in putting Pambiar water into the lake before, say, the middle of December. Of course the two new works referred to in paragraph 2 of this report, which will, I understand, increase the capacity of the lake which can be drawn on to the extent of nearly 4,000 millions cubic feet, will completely alter the condition of affairs, but I am not in a position to say how far the Periyár river itself is capable of meeting this additional demand. On this depends whether Pambiar water has to be independently stored or not, and on this depends the height of the dams and to a certain extent the length of the tunnel. I have no doubt that this point can be settled before work is begun again and also how much water is wanted from the Pambiar. With this information given to me I would propose to continue the investigation as follows:—

(i) I would continue the survey of the Pambiar river and its tributaries so as to ascertain as accurately as possible the catchment area of the river.

(ii) Select a site for the dam across the Pambiar and run contours above this site at, say, every 5 feet so as to ascertain the storage capacity.

(iii) Do the same for the Meenar.

(iv) Complete the survey of the Kullar river and then lay down the line of the tunnel.

(v) Select a site for a dam on the Kullar river and contour as in (ii).

8 A gauge has been put up in the bed of the Pambiar river at a suitable place and arrangements have been made for regular readings during the flood season.

Statement showing the latest date on which the lake surplussed and the dates of opening and closure of tunnel at Periyár lake.

Years.	Latest date on which the lake surplussed		Tunnel.	
	South-west monsoon.	North-east monsoon.	Date of opening.	Date of closing.
1896–1897 ..	21st August 1896 ..	31st December 1896 ..	1st July 1896 ..	18th March 1897.
1897–1898 ..	9th September 1897 ..	3rd ,, 1897 ..	6th June 1897 ..	7th ,, 1898.
1898–1899 ..	....	....	29th May 1898 ..	19th February 1899.
1899–1900 ..	21st July 1899 ..	....	2nd ,, 1899 ..	1st March 1900.
1900–1901 ..	21st September 1900 ..	6th December 1900 ..	8th June 1900 ..	27th ,, 1901.
1901–1902 ..	23rd August 1901 ..	15th ,, 1901 ..	26th May 1901 ..	20th ,, 1902.
1902–1903 ..	....	26th ,, 1902 ..	28th ,, 1902 ..	24th ,, 1903.
1903–1904 ..	21st September 1903 ..	23rd ,, 1903 ..	31st ,, 1903 ..	11th ,, 1904.
1904–1905 ..	20th August 1904 ..	....	30th ,, 1904 ..	10 h ,, 1905.
1905–1906 ..	....	....	4th June 1905 ..	16th ,, 1906.
1906–1907 ..	7th September 1906 ..	26th November 1906 ..	19th ,, 1906 ..	19th ,, 1907.

Order—No. 280 I., dated 18th June 1907.

Recorded.

2. The Government note with satisfaction that the scheme for diverting the P..mbiar into the Periyár lake is physically practicable. Mr. S. B. Murray on return ..om leave will be reposted to complete the investigation with Messrs. K. T. B. Tressler and H. W. Milner as Assistant Engineers.

3. The Chief Engineer, Public Works Department, will make the necessary arrangements for the posting of the above officers at the proper time.

(True Extract.)

H. E. CLERK,
Ag. Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Chief Engineer for Irrigation with a blue print.
,, the Superintending Engineer, VI Circle with a blue prints.
,, the Examiner, Public Works Accounts.
,, the Chief Engineer, Public Works Department.
,, Mr. S. B. Murray, care of India Office with a blue print.

Forwarded to the

(By order.

Deputy Registrar.

PUBLIC WORKS DEPARTMENT
(IRRIGATION BRANCH).

NOTES CONNECTED WITH G.O., No. 280 I., DATED 18TH JUNE 1907.

[SUBJECT.—*Report showing the results of the Periyár-Pambiar Investigation Party from November 1906 to April 1907.*]

From the Executive Engineer, Periyár-Pambiar Investigation Party, dated 20th April 1907, No. 20-E.I.

Under Secretary—

In his note,* dated 26th March 1906, on the extension of irrigation on the Periyár canal system, the Inspector-General of Irrigation suggested that the Madras Government might be asked to carry out investigations with a view to extend the catchment area of the Periyár lake by diverting into it the Pambiar river. This suggestion was accepted by the local Government and Mr. Murray, Executive Engineer, was accordingly posted to take charge of the investigation.

* Printed on pages 3 and 4 of G.O., No. 702 I., dated 27th June 1906.

With the current quoted above, the Executive Engineer submits a report, together with a map and statement, showing the results of the work of the party and states that the investigation should be continued again, after the monsoon is over, on the following lines :—

(1) to continue the survey of the Pambiar river and its tributaries with a view to ascertain accurately the catchment area of the river ;

(2) to select a site for the dam across the Pambiar and to run contours above this site to ascertain the storage capacity ;

(3) to do the same for the Meenar ;

(4) to complete the survey of the Kullar river and then lay down the line of the tunnel, and

(5) to select a site for a dam on the Kullar river and to run contours above this site to ascertain the storage capacity.

If it is decided to continue the further investigation and that he (Mr. Murray) is to be in charge of the work, Mr. Murray requests that Messrs. Milner and Tressler may be placed under his orders and that he may be informed of the result of the decision, so that work may be started before he returns from leave.

For orders.

S. A. VENKATA RAMA AIYAR.
23-4-07.

S. DORASAMY AIYAR.
23-4-07

Joint Secretary—

As Mr. Murray does not on his present information feel himself equal to any attempt at even the roughest estimate of probable cost, it seems somewhat presumptuous to endeavour to make one. The following may, however, throw a little light on the subject.

An examination of the levels given on the survey shows that we have between the Pambiar and the Kullar an available fall of about 100 feet, and by building masonry anicuts of say 25 feet high on the Pambiar and Meenar and making a cut through the ridges separating them we could get a tunnel about 3 miles in length debouching on the Kullar at about its bed level with a fall of 1 in 150, whence an open cutting would join the Periyár. The discharge of the existing Periyár tunnel when water in the lake is a little above the top of the sluice vent is about 1,250 cusecs, giving a value of $N = \cdot 020$, its section is $12 \times 7\frac{1}{2}$ and its cost was very nearly Re. 1 per cubic foot. Using this value of N we find that a tunnel of section $12' \times 9'$ with fall of 1 in 150 gives a discharge of 1,274 cusecs.

Such a tunnel running full for two months and half full for three months would discharge 11,000 millions cubic feet irrigating say 50,000 acres and giving a net revenue of fully 2 lakhs, or the supply might be used mainly for power purposes and irrigation made a secondary consideration.

The following figures might be within a reasonable per centage of the cost of the irrigation scheme:—

	RS.
Dams on the Pambiar and Meenar	2,00,000
Three miles tunnel at Rs. 108 per foot	17,30,000
Cutting from Kullar into Periyár and dam on Kullar	2,00,000
Enlarging Periyár tunnel by 50 per cent	2,50,000
Distribution works at 12 Rs. per acre including widening Periyár main channel	6,00,000
Machinery	1,20,000
Unforeseen items	1,00,000
Total, works ...	32,00,000
Supervision and Tools and Plant at 25 per cent.	8,00,000
Grand Total ...	40,00,000

Giving a return of 5 per cent. on expenditure.

It will be seen from the section of the tunnel compared with that of the Periyár that little saving would be made on it by having high dams on the Pambiar and Meenar to get a greater fall, and it is therefore fairly evident that the scheme roughed out above is as cheap as or cheaper than any other giving the same quantity of water. Examination of the tables and diagrams prepared in connection with the power scheme would give some idea as to the necessity or otherwise of increased storage and they will be got up from Madras, but of course until something is known of the quantity of water available all calculations are suppositons. If approved, Mr. Murray's report might be sent to Revenue Department for information with a remark that the scheme looks hopeful.

T. W. S. Smyth.
26–4–07.

There is not enough information available to make any estimate on which any reliance can be placed. All that is known at present is that the scheme is practicable and further investigation must be carried out. Mr. Murray has now become so well acquainted with the country that it is advisable that he should continue the work on his return. Otherwise I would have suggested beginning operations earlier. Mr. Milner has been sent to take charge of Tank Restoration Scheme work in III Circle and I doubt if it is advisable to move him. Operations cannot therefore well be begun

until Mr. Murray's return when operations can be started again. An Assistant Engineer will be required to take Mr. Milner's place. Will the Secretary Public Works Department kindly note this and return the file in order that Mr. Murray's report may be sent to His Excellency for perusal?

A

H. E. Clerk,
29-4-07.

To the Public Works Department u.o.

Public Works Department.

Under Secretary—

The portion marked **A** has been noted and will be brought forward at the proper time.

T. S. Ramasamy Aiyar.
1-5-07.

Chief Engineer for Irrigation u.o.

A. G. Romilly.
1-5-07.

Public Works Department
(Irrigation Branch).

Under Secretary—

Submitted.

B. Gopal Row.
2-5-07.

T.W.S.S.
3-5-07.

His Excellency the Governor—

H.E.C.
3-5-07.

The further investigation of the work should certainly be prosecuted on Mr. Murray's return.

It would be of advantage if Mr. Milner could be spared to get the work in hand in anticipation of Mr. Murray's return.

A. L[awley].
24-5-07.

Since I wrote note, dated 29th April 1907, Mr. Allen has asked to have Mr. Lakshminarayana Aiyar, an officer from Hyderabad appointed for charge of Tank Restoration Scheme work. Mr. Milner will then presumably be available for starting work again at Periyár.

H.E.C.
27-5-07.

To the Public Works Department u.o.

Public Works Department.

Under Secretary—

The posting of Messrs. Murray, Milner and Tressler to the Pambiar investigation will be brought forward at the proper time. The file may be returned to the Chief Engineer for Irrigation.

T.S.R.
3-6-07.

Chief Engineer for Irrigation u.o.

A.G.R.
3-6-07.

PUBLIC WORKS DEPARTMENT
(IRRIGATION BRANCH).

Under Secretary—

Submitted that the progress report received from the Executive Engineer, Periyár-Pambiar Investigation Party, showing the results of work during the last season may be recorded in a Government order. Draft order is submitted below for approval.

B.G.R.
6-6-07.

H.E.C.
6-6-07.

To the Public Works Department u.o.

PUBLIC WORKS DEPARTMENT.

Seen and returned.

T.S.R.

To the Chief Engineer for Irrigation—

A.G.R.
11-6-07.

Issue.

T.W.S.S.
12-6-07.

[Issued as G.O., No. 280 I., dated 18th June 1907.]

E. I. Form No. 1.

PUBLIC WORKS DEPARTMENT,
IRRIGATION BRANCH.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

18 P

READ again the following

G. O. P. W. D. ~~Irrigation~~ Private Branch No 702 I dt 27-6-1906

Read also

From the Executive Engineer, Periyar Pambiyar Investigation Party No 20 E.I. dt 20-4-1907.

Private
Print Report

Print Notes

Order No. 280-I. D/18-6-07

Recorded

18 P

2. The Government note with satisfaction that the scheme for diverting the Pambiar into the Periyar lake is physically practicable ~~and consider that the further investigation of the Project should be conducted by Mr S. B. Murray on his return from leave and his staff consisting of Messrs Tressler and S.W. Milner Assistant Eng~~

Mr S. B. Murray on return from leave will be reposted to complete the investigation with Messrs K. T. B. Tressler & H. W. Milner as Assistant Engineers.

3. The Chief Engineer P W D will make the necessary arrangements for the posting of the above officers at the proper time.

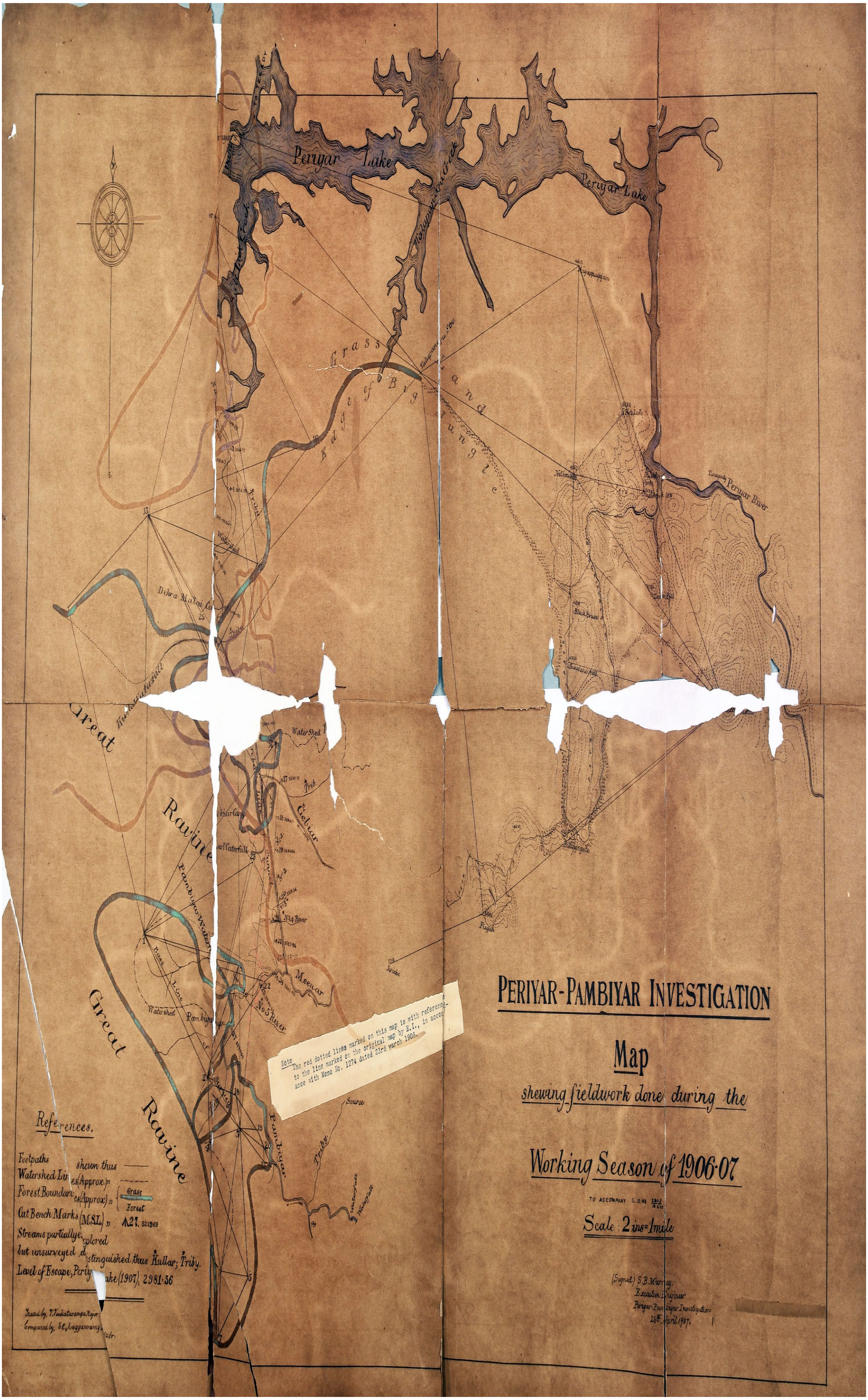
[signature]
D. I.
6/6/07

[signature]
6/6/07 I.

Issue
[signature]

To. The Chief Engineer for Irrigation [initials] 6.6.07 with a blue print
Supg Engr 6th Circle " 2 blue prints
" Exr. P W accts
" Chief Engineer P W D
Mr. S. B. Murray c/o India Office
Ord & Press

DESPATCHED 2/6/07



PERIYAR-PAMBIYAR INVESTIGATION
Map
shewing fieldwork done during the
Working Season of 1906-07
TO ACCOMPANY G.O.No
Scale: 2 ins=1 mile
(Signed) S.B. Murray.
Executive Engineer
Periyar-Pambiyar Investigation
28th April 1907.
Note The red dotted lines marked on this map is with reference to the line marked on the original map by E.I., in accordance with Memo No. 1274 dated 23rd March 1908.
References.
Footpaths shewn thus
Watershed Lines (Approx.) "
Forest Boundaries (Approx.) "
Grass
Forest
Cut Bench Marks (M.S.L.) "
27. 3223.69
Streams partially explored
but unsurveyed distinguished thus Kullar; Triby.
Level of Escape, Periyar Lake (1907), 2981·36
Periyar Lake
Periyar Lake
Periyar River
Grass Land
Edge of Big Jungle
Great Ravine
Great Ravine
Pambiyar
Meenar
No 5 River
No 4 River
Water Shed
Trib.
Source
Waterfall
Waterfall
Pisgah
Jericho
Watershed

90 — 1 — 10

Extra — 1 — 10

30